



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/579,402	05/25/2000	KEI-YU KO	11675.114.1	7953
21567	7590	06/18/2004	EXAMINER	
WELLS ST. JOHN P.S. 601 W. FIRST AVENUE, SUITE 1300 SPOKANE, WA 99201			LEE, EUGENE	
			ART UNIT	PAPER NUMBER
			2815	

DATE MAILED: 06/18/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/579,402	Applicant(s) KO, KEI-YU AK	
	Examiner Eugene Lee	Art Unit 2815	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 26 May 2004.
 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-9 and 11-30 is/are pending in the application.
 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
 5) ☐ Claim(s) _____ is/are allowed.
 6) ☒ Claim(s) 1-9 and 11-30 is/are rejected.
 7) ☐ Claim(s) _____ is/are objected to.
 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 a) ☐ All b) ☐ Some * c) ☐ None of:
 1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
 * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 5/26/04 has been entered.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1, 3, 5 thru 8, 11, 13, 15 thru 18, 22, and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bronner et al. 5,792,703 in view of Lee et al. 5,192,703 in view of Lai et al. 5,229,311 in view of Joshi et al. 5,403,779. Bronner discloses (see, for example, FIG. 5) a gate stack 60 comprising a gate insulating layer (gate oxide layer), gate electrode (gate layer), insulating sidewall spacers (spacer) and a cap insulator (silicon dioxide cap) wherein the gate stack is formed on a substrate (semiconductor material layer) 50. A connecting stud (contact plug) 80' resides in an insulator (layer of doped silicon dioxide) 85'. Bronner does not disclose a layer of refractory metal silicide on said gate layer. Lee discloses (see, for example, FIG. 22) a gate stack structure comprising a metal silicide layer 15 on top of a gate layer 10. The

Art Unit: 2815

metal silicide layer reduces the resistance of the gate electrode. Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to include the metal silicide layer in Bronner's invention in order to reduce the resistance of the gate electrode.

Bronner in view of Lee does not disclose a conductive layer being disposed along said lateral wall of said contact plug. However, Lai discloses (see, for example, FIG_1) a semiconductor device comprising a barrier metal layer (conductive layer) 19 and metal layer 20. In column 5, lines 47-48, Lai discloses the barrier layer being titanium. Lai further discloses (see, for example, column 5, lines 33-46) that the barrier metal layer acts as a block and prevents excess charge loss. Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to use barrier metal layer (conductive layer) of Lai in Bronner in view of Lee in order to act as a block and prevent excess charge loss.

Bronner in view of Lee in view of Lai does not disclose the second conductive material physically contacting the semiconductor material layer. However, Joshi discloses (see, for example, FIG. 8 and TABLE 2) a conducting material and a collimated sputtered liner (second conductive material) wherein the conducting material physically contacts a semiconductor substrate. In column 4, lines 64-column 5, lines 4, Joshi discloses the liner as an effective diffusion barrier and in column 12, lines 6-11, as an adhesion promoter. Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to have the second conductive material physically contact the semiconductor material layer in order to create a diffusion barrier, promote adhesion, and make an overall better conductive line.

Art Unit: 2815

Regarding the limitation "layer of doped silicon dioxide" in line 19 of claim 1, and claim 6, see, for example, column 4, line 17 of Bronner wherein Bronner states the insulating layer 85' comprising PSG or BPSG glasses.

Regarding the limitation in line 7 of claim 1 that the cap is silicon dioxide, see, for example, column 3, lines 19-22 of Bronner wherein Bronner states the insulator comprising silicon dioxide.

Regarding claims 3 and 7, Bronner does not disclose the nonconductive material as being undoped silicon dioxide. However, Lee discloses (see, for example, column 5, line 53) that the nonconductive material may be silicon dioxide. Silicon dioxide has excellent insulative properties for a spacer. Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention to use silicon dioxide, since silicon dioxide has excellent insulative properties for a spacer, and since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. In re Leshin, 125 USPQ 416.

Regarding claim 5, see, for example, column 5, line 42 of Lee wherein Lee states a tungsten silicide (WSi_x) layer.

Regarding claim 8, see, for example, column 3, line 17 of Bronner wherein Bronner states a polysilicon electrode.

4. Claims 2 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bronner et al. '703 in view of Lee '703 in view of Lai et al. '311 in view of Joshi et al. '779 as applied to claims 1, 3, 5-8, 11, 13, 15-18, 22, and 26 above, and further in view of Havemann 5,482,894.

Art Unit: 2815

Bronner in view of Lee in view of Lai in view of Joshi does not disclose the nonconductive material comprising silicon nitride. However, Havemann teaches (see, for example, column 2, line 66) that many different insulative materials (such as silicon nitride) may be used in the spacers of a gate stack structure. Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention to use silicon nitride, since silicon nitride has good insulative properties for a spacer, and since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. In re Leshin, 125 USPQ 416.

5. Claims 4, 9, 14, 19, 20, 24, 28, and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bronner et al. '703 in view of Lee et al. '703 in view of Lai et al. '311 in view of Joshi et al. '779 as applied to claims 1, 3, 5-8, 11, 13, 15-18, 22, and 26 above, and further in view of Ahmad et al. 5,208,176. Bronner in view of Lee in view of Lai in view of Joshi does not disclose the semiconductor material being made of monocrystalline silicon. However, Ahmad discloses (see, for example, column 3, lines 39-43) that DRAM semiconductor devices are typically formed on monocrystalline silicon. Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to use monocrystalline silicon in Bronner in view of Lee in view of Lai in view of Joshi in order to have a substrate suitable for a semiconductor device with minimum crystal defect and a smooth surface.

6. Claims 21 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bronner et al. '703 in view of Lee et al. '703 in view of Lai et al. '311 in view of Joshi et al. '779 as

Art Unit: 2815

applied to claims 1, 3, 5-8, 11, 13, 15-18, 22, and 26 above, and further in view of Huang et al. 5,393,704. Bronner in view of Lee in view of Lai in view of Joshi does not disclose the conductive layer being only a refractory metal silicide. However, Huang discloses (see, for example, FIG. 6C) a semiconductor device comprising a barrier metal layer (conductive layer) 40 and metal layer 42. The barrier metal layer prevents the metal layer 42 from diffusing into the region 36. In column 3, lines 55-57, Huang discloses the barrier metal layer comprising titanium silicide (refractory metal silicide). Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to have the conductive layer being only a refractory metal silicide in order to prevent the diffusion of the connecting stud of Bronner in view of Lee in view of Lai in view of Joshi into another region.

7. Claims 23, 27, and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bronner et al. '703 in view of Lee et al. '703 in view of Lai et al. '311 in view of Joshi et al. '779 in view of Ahmad et al. '176 as applied to claims 4, 9, 14, 19, 20, 24, 28, and 30 above, and further in view of Huang et al. 5,393,704. Bronner in view of Lee in view of Lai in view of Joshi in view of Ahmad does not disclose the conductive layer being only a refractory metal silicide. However, Huang discloses (see, for example, FIG. 6C) a semiconductor device comprising a barrier metal layer (conductive layer) 40, and metal layer 42. The barrier metal layer prevents the metal layer 42 from diffusing into the region 36. In column 3, lines 55-57, Huang discloses the barrier metal layer comprising titanium silicide (refractory metal silicide). Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to have the

Art Unit: 2815

conductive layer being only a refractory metal silicide in order to prevent the diffusion of the connecting stud of Bronner in view of Lee in view of Lai in view of Joshi into another region.

Response to Arguments

8. Applicant's arguments with respect to claims 1-9, and 11-30 have been considered but are moot in view of the new ground(s) of rejection.

INFORMATION ON HOW TO CONTACT THE USPTO

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Eugene Lee whose telephone number is 571-272-1733. The examiner can normally be reached on M-F 8-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on 703-308-2772. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Eugene Lee

Application/Control Number: 09/579,402

Page 8

Art Unit: 2815

February 13, 2004

Tom Thomas

TOM THOMAS
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800